

THE ECONOMICS OF TOBACCO CONTROL IN JAMAICA: WILL THE PURSUIT OF PUBLIC HEALTH PLACE A FISCAL BURDEN ON THE GOVERNMENT?

Report written for the Ministry of Health and funded by Research for International Tobacco Control, housed in the International Development Research Centre, Ottawa

Main author: Corné van Walbeek, School of Economics, University of Cape Town, South Africa

1. INTRODUCTION

Tobacco related illnesses resulted in approximately 4 million deaths worldwide in 2003. By 2030 the expected annual death toll is expected to rise to 10 million, of which seven million are expected to be in developing countries (World Bank, 1999). The human suffering caused by smoking is immense. Studies in developing countries (USDHHS, 2000: 97 and Jha, et al., 2000a: 158) have shown that a majority of current smokers want to quit the habit, but find it very difficult to do so.

Epidemiological research indicates that for every four regular smokers, on average one will be killed by their habit before age 69 and another in old age (i.e. after age 69) (Galalakshmi, et al, 1999: 34). For those people who die before age 69, it has been estimated that they lose, on average, approximately 20 life years because of smoking.

International agencies like the World Health Organisation (WHO) have placed tobacco control high on the agenda. Through the Tobacco Free Initiative the WHO has initiated the Framework Convention on Tobacco Control (FCTC). The FCTC was unanimously accepted in May 2003 and is currently being ratified by the signatory countries. In an increasingly integrated world, an integrated response to the challenge of increasing global tobacco consumption is required. The FCTC aims to lay down

certain minimum standards in tobacco control that signatory countries would make part of their domestic legislation.

Specifically, the FCTC aims to reduce the consumption of tobacco through the following measures aimed at reducing the *demand*:

- Price and tax measures;
- Protection from exposure to environmental tobacco smoke;
- Regulation and disclosure of the contents of tobacco products;
- Packaging and labelling;
- Education, communication, training and public awareness;
- A comprehensive ban on tobacco advertising, promotion and sponsorship; and
- Tobacco dependence and cessation methods (Shibuya, et al., 2003).

The FCTC aims to curb the *supply* of tobacco through the following means:

- Eliminating the illicit trade of tobacco products;
- Restricting the sales of tobacco to and by minors; and
- Supporting economically viable alternatives for tobacco growers.

The FCTC has been vigorously opposed by the tobacco industry. One can understand their opposition, given that their vested interests are being threatened. In fact, the tobacco control debate sometimes is presented as a struggle between the public health interests of the medical community and the commercial interests of the tobacco and related industries. The tobacco industry often presents itself as an economically important industry, employing many people, and an important source of government revenue (see, for instance, Prince, 2003, on the role of the tobacco industry in the Jamaican economy).

While this may be true, the industry tends to ignore the fact that its product causes not only non-economical costs on its users (e.g. pain and suffering and grief of relatives), but because of premature mortality and increased morbidity also places a heavy economic burden on society. Rather than focusing on the gross contribution of the industry on society, a more realistic assessment would be to consider the *net* contribution. A number of studies (see Chaloupka, Jha and Peck, 1998 and Peck, et

al., 1999) have performed cost-benefit analyses and the results suggest that, if some smokers are uninformed about the health consequences of their habit, an increase in the excise tax on cigarettes will enhance global welfare.

The economic rationale for levying an excise tax on cigarettes is based on the fact that the social costs of smoking are greater than the private costs. According to Townsend (1996: 138) a number of principles underlie the imposition of an excise tax: Firstly, taxes are imposed to correct for externalities (i.e. to increase the private cost of smoking so that it equals the social cost). Secondly, an excise tax on tobacco is a particularly useful way to generate government revenue. Given the relatively low price elasticity of demand (discussed in section 4) the Ramsey rule suggests that cigarettes are more suitable than many other consumer goods as an object of taxation. Thirdly, the tax can be levied to deter tobacco consumption (i.e. the tax is a sumptuary tax). It is a popular tax in many countries, indicated by the fact that a majority of people, including a sizeable proportion of smokers, support excise tax increases.

The aim of this paper is to investigate the economics of tobacco control in Jamaica. The focus will be primarily on the role that an increase in excise taxes has on the price of cigarettes and the demand for cigarettes. Empirical estimates of the sensitivity of the demand for cigarettes to a change in the price of cigarettes will be provided. Also, the implications of a tax increase on government revenue will be discussed. As will be pointed out in this paper, the empirical literature is practically unanimous that an increase in tobacco excise taxes is the most effective way of reducing cigarette consumption. A secondary focus of this paper is to investigate other factors that have an impact on the demand for cigarettes. Because of limited data this paper will often refer to the experiences of other countries, both developed and developing.

2. THE ROLE OF TOBACCO IN THE JAMAICAN ECONOMY

In Table 1 below some macroeconomic and tobacco related trends are shown for Jamaica for the period 1972-2001. From a macroeconomic perspective the past three decades have been difficult for Jamaica. Although the rapid decrease in the GDP per capita during the early and mid-1970s has been stemmed, the period since 1980 has been characterised by economic stagnation, rather than economic growth. Also, the

country has been subject to some bouts of high inflation. Fortunately, inflation has been brought under control in the past five years.

Table 1: Some important macroeconomic and tobacco control related data in Jamaica, 1972-1990

Year	Population (aged 15 years and older)	Real GDP per capita (15 years and older)	Inflation rate	Cigarette production per capita (15 years and older)	Cigarette consumption per capita (15 years and older)	Real cigarette price
1972	1064700	168944		1416	1575	
1973	1093000	174850	20.0	1354	N/a	
1974	1120900	160511	25.0	1380	1400	39.33
1975	1150600	150646	13.3	1413	1258	39.65
1976	1174005	135083	11.8	1315	1278	40.76
1977	1199600	129605	10.5	1233	1209	39.30
1978	1231000	126489	38.1	1078	1071	42.03
1979	1260400	121758	27.6	1070	936	36.60
1980	1289300	112182	27.0	996	940	39.15
1981	1333400	113716	12.8	934	892	49.15
1982	1367300	110024	7.5	1034	989	47.42
1983	1409924	110219	10.5	964	965	46.96
1984	1438221	106678	28.6	883	843	46.51
1985	1464188	100924	25.9	897	889	50.36
1986	1486093	100529	14.7	767	756	54.50
1987	1499147	107412	6.8	849	842	52.66
1988	1509338	109617	8.0	863	852	55.56
1989	1538551	115016	14.8	899	888	49.46
1990	1559186	120218	21.9	885	865	46.74
1991	1587095	119481	50.8	768	739	46.70
1992	1586033	121401	77.5	819	817	41.36
1993	1606564	122158	21.9	762	762	47.55
1994	1630268	121425	35.2	781	778	50.75
1995	1656291	120768	19.9	732	732	53.20
1996	1678230	117971	26.4	726	724	49.39
1997	1701153	114301	9.7	691	676	53.29
1998	1720703	112699	8.7	674	662	58.57
1999	1736582	111117	5.9	618	608	65.80

2000	1752873	110856	8.2	568	562	65.92
2001	1754936	112592	7.0	585	606	66.09
Average annual growth rates						
1972-1980	2.4	-5.0	21.7	-4.3	-6.2	-0.1*
1980-1990	1.9	0.7	15.2	-1.2	-0.8	1.8
1990-1995	1.2	0.1	41.1	-3.7	-3.3	2.6
1995-2000	1.1	-1.7	11.8	-4.9	-5.1	4.4
2000-2001	0.1	1.6	7.0	3.0	7.8	0.3

* 1974-1980

Sources: To be supplied by Stanley Lalta and Dr Eva Fuller

Considering per capita production and consumption of cigarettes, there has been a sharp decrease in both of these in the past three decades. Per capita consumption of cigarettes has decreased by between 50 and 60 per cent since the early 1970s.¹ Aggregate cigarette consumption has decreased by about a third, despite the fact that the Jamaican population has increased by 65 per cent between 1972 and 2001.

From a tobacco control perspective this long-term decrease in cigarette consumption has been most encouraging. Two questions that arise from this are the following:

1. Why has there been such a rapid decrease in cigarette consumption in Jamaica in this 30-year period?
2. It is possible that smokers have converted their consumption patterns to other forms of tobacco and to cannabis, rather than cigarettes?

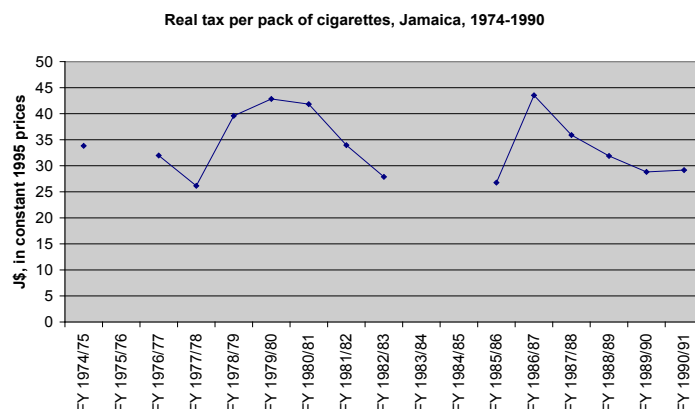
Consider the first issue. In section 4.1 a review on the international empirical literature on the determinants of the demand for cigarettes is provided. As will be pointed out in that section, the empirical literature is overwhelming in its conclusion that the two most important determinants of the demand for cigarettes are the price of cigarettes and income levels. In Figure 1 the empirical relationship between Jamaica's per capita cigarette consumption and per capita income is shown in the form of a scatter plot. The relationship between these two variables is clearly positive. In Figure

1. The data in this table closely corresponds to the per capita cigarette consumption figures published in the second edition of the Tobacco Control Country Profiles, published in 2003. The per capita consumption figures for 1980, 1990, 1995 and 2000 from the Country Profiles were as follows (this table's data in parentheses): 952 (940), 879 (865), 742 (732), and 565 (562).

2 the relationship between the real price² of cigarettes and per capita consumption is shown. Other than the two axes having been switched (i.e. the price of cigarettes is shown on the horizontal axis, rather than the more conventional vertical axis, and the quantity is shown on the vertical axis, rather than the more conventional horizontal axis), this scatter plot traces out a demand curve for cigarettes in Jamaica. The negative relationship between cigarette consumption and its real price is clearly demonstrated. If cigarette prices were to have no impact on the quantity of cigarettes consumed, the scatter plot in Figure 2 would not have shown any discernable relationship.

An analysis of Table 1 indicates that the real price of cigarettes has been increasing steadily throughout the three decades under consideration. Unfortunately, the sparse data that are available does not allow one to fully investigate why the real price on cigarettes has been increasing. However, an investigation of cigarette excise duty and consumption duty revenues of the 1970s and 1980s suggests that an increase in the tax on cigarettes was *not* primarily responsible for an increase in the real retail price in the 1970s and 1980s.³ However, no data are available for the period 1990 to 1997, so one cannot say anything about this period.

2. The real price is discussed in more detail in section 4.1. To derive the real price of a product one removes the impact of inflation on the price of that product.
3. The Jamaican Ministry of Health supplied some tentative data on revenues obtained from excise duty and consumption duty for the period 1974 to 1990. From these data the average tax per pack of cigarettes was calculated. Given the large changes in the price level during some of these years, the real values are likely to suffer from some distortion. However, keeping these caveats in mind, an analysis of the long-term trend in the real tax suggests that the real tax per pack of cigarettes has not shown any long-term upward trend for the period 1974 to 1990. However, there have been some cycles in the real tax in this period as shown in the graph below.



While it is acknowledged that the data is not particularly robust, it seems that the main explanation for the increase in the real price of cigarettes in Jamaica is not an increase in taxes, but rather an increase in that proportion of the retail price that is received by the cigarette manufacturing industry and all related industries (such as wholesalers, retailers and distribution agencies).

In section 4.2 the relationship between cigarette consumption and its determinants are investigated more rigorously by means of multiple regression analysis.

Figure 1: Per capita cigarette consumption vs. per capita GDP, Jamaica, 1974-2001

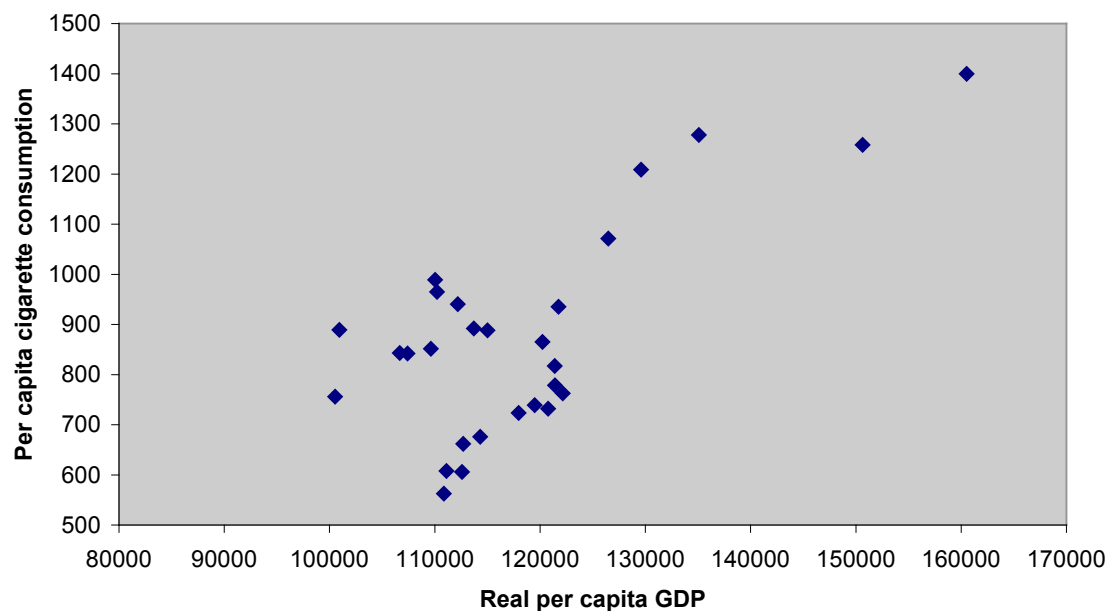
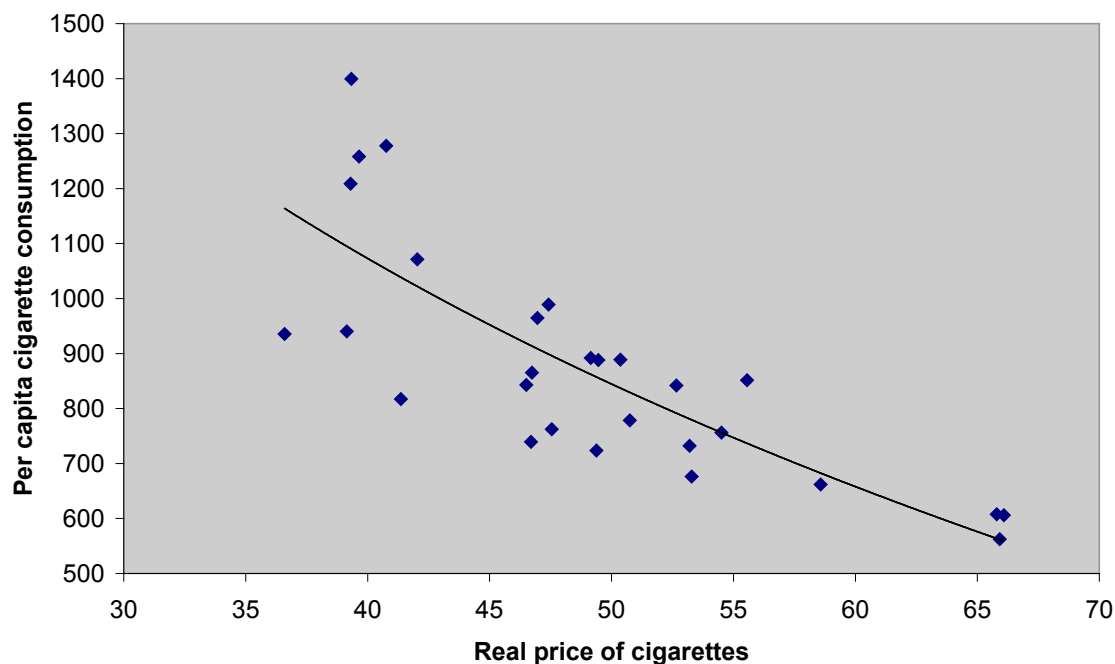


Figure 2: Per capita cigarette consumption vs. the real price of cigarettes, Jamaica, 1974-2001



While changes in consumers' income and changes in the real price of cigarettes clearly have had a pronounced impact on the demand for cigarettes, changes in the prices of and demand for substitutes to cigarettes could also have had an impact on the demand for cigarettes. In Jamaica the most common substitute to cigarettes are (Stanley and Eva to expand).

A component of the explanation of the decline in cigarette consumption over the three decades may well be the increased use of marijuana (ganja) and to a lesser extent, other recreational drugs. Marijuana is illegal in Jamaica and obtaining accurate data on its consumption is very difficult as is the price of this product. According to a survey of the National Council on Drug Abuse (NCDA) among school children (ages 10 - 18 years) the usage rate of marijuana in 1987 was 20 per cent, and it increased to 27 per cent in 1997. Over the same period the use of tranquillisers also increased from 3.8 per cent to 5.5 per cent (Eva Lewis-Fuller, personal communication).

3. CIGARETTE TAXES AND GOVERNMENT REVENUE

As in most countries, cigarettes sold in Jamaica are subject to excise and other taxes. The composition of the tax burden is more complex than in many other countries. In Jamaica cigarettes are subject to the following taxes:

- Import duty: 30 % (applicable only on imported cigarettes);
- Stamp duty: 56 % (applicable to all cigarettes? Question to Stanley and Eva);
- General Consumption Tax: 15 %
- Special consumption tax:
 - \$128.61 per 100 cigarettes
 - an ad valorem tax of 39.9 % on cigarettes in excess of a benchmark value of \$252.39 per 100 cigarettes (Prince, 2003).

The focus in this section is on total cigarette tax, irrespective of the source. Cigarette taxation is an important source of government revenue, responsible for XX per cent of total revenue (Eva to supply figure). In Table 2 the relationship between some important tax-related variables are shown for the period 1997-2001.⁴ Unfortunately the data are limited, but some important trends can nevertheless be inferred.

Table 2: Jamaica's cigarette taxes, 1997-2001

Year	Cigarette tax revenue (J\$ millions, nominal amounts)	Cigarette tax revenue (J\$ millions, constant 1995 prices)	Total cigarette consumption (million packs)	Cigarette tax per pack (J\$/pack, constant 1995 prices)	Tax burden as percentage of retail price (percentage)
(1)	(2)	(3)	(4)	(5)	(6)
1997	2022	1458	57.51	25.36	47.6
1998	2346	1557	56.93	27.35	46.7
1999	2563	1606	52.77	30.44	46.3
2000	2716	1573	49.29	31.93	48.4
2001	2762	1496	53.17	28.14	42.6

Sources:

Prince, 2003 (for cigarette tax revenues)

Stanley and Eva to supply sources for consumption, cigarette prices and CPI

Firstly, it is evident that total cigarette tax revenues, in nominal terms, have been increasing at a steady rate over the past five years. This is something that the tobacco industry would regularly point out. However, because of inflation practically all magnitudes measured in monetary terms tend to increase in nominal value over time. A far more appropriate approach is to consider *real* changes (i.e. where the impact of inflation is removed from the analysis). The picture is significantly different in this

4. Unfortunately it was impossible to synchronise these data with the data of 1974-1990, which were used in a previous footnote.

case. Real tax revenues from cigarettes increased by about 5 per cent annually in 1998 and 1999, but decreased by an average of 3.5 per cent per year in the subsequent two years. The net result was that real value of total cigarette tax revenue in 2001 was only fractionally more than the real value in 1997.

The degree of correlation between real cigarette tax revenue (col. 3) and the real tax per pack of cigarette (col. 5) is much greater ($r = 0.80$) than the correlation between real cigarette tax revenue (col. 3) and total cigarette consumption (col. 4, $r = -0.54$). With the exception of 2000, an increase in the real tax per pack of cigarettes has resulted in an increase in real government revenue, and vice versa.⁵ What this analysis thus suggests is that, in order to increase tax revenue, the government should increase the tax per pack of cigarettes. While an increase in the tax per pack of cigarettes is likely to decrease the consumption of cigarettes by some amount, the decrease in the quantity is very small in comparison to the increase in the tax per pack of cigarette that the government will receive.

This is a very important result. The tobacco industry around the world has often argued, and might argue this in Jamaica as well, that increases in the excise tax on cigarettes may not result in an increase in government revenue, because the decrease in cigarette consumption will nullify the impact of the change in the tax. This assertion has been proven false around the world (see Chaloupka and Warner, 1999, World Bank, 1999: 72, and ETCSA, 2003), and based on the limited data presented in Table 2, does not carry empirical weight in Jamaica either.

Can the government of Jamaica extract more revenue from tobacco by increasing the tax? As will be shown in section 5, the answer is a clear yes. It will be shown that, despite the long-term decrease in cigarette consumption in Jamaica in the past 30 years, the government has significant scope to increase the tax on cigarettes. This will have positive public health consequences (tobacco consumption will decrease) and

5. In 2000 per capita cigarette consumption decreased by approximately 7.5 per cent, and this was responsible for the 2 per cent decrease in real cigarette tax revenue in that year, despite the fact that the real tax per pack of cigarettes increased by nearly 5 per cent. The decrease in cigarette consumption cannot be ascribed to either a large decrease in per capita income or a large increase in the real price of cigarettes. Given the data available, the cause of this decrease in cigarette consumption remains unresolved.

will also be beneficial to the national treasury (because real tax revenues will increase).

DETERMINANTS OF CIGARETTE DEMAND

An international perspective

So what determines the demand for tobacco products? Standard microeconomic theory typically identifies the following determinants of the quantity demanded of any product:

- Price of the product;
- Income;
- Prices of related products (i.e. substitutes and complements); and
- Tastes and preferences.

In the international tobacco control literature a number of additional demand factors have been identified. These include the following:

- Legislative interventions aimed at reducing smoking in public places and workplaces;
- Advertising expenditure and restrictions on advertising;
- Increased awareness of the risks of smoking (e.g. the publication of the Royal College of Physicians Report in 1962 and the US's Surgeon-General Report in 1964, other "health scares", and counter-advertising).

From a policy perspective it is useful to know which interventions are effective and which are not. In the following sections each one of these determinants of smoking will be discussed, based on international experience.

a) Price of cigarettes

Of all the tobacco control interventions, by far the most effective one is increasing the price of cigarettes. According to the most well-known relationship in microeconomics - the law of demand - the quantity demanded of a typical product will decrease as the

price of that product increases. But does the law of demand apply to an addictive product like cigarettes? There was a period where it was believed that addictive goods are not subject to the law of demand, because people will buy these goods, irrespective of the price (see studies quoted in Chaloupka and Warner, 1999: 4). However, despite its addictive nature, dozens and even hundreds of empirical studies have found that the price of cigarettes is negatively related to the quantity demanded (see Chaloupka and Warner, 1999, Van der Merwe, 1998 and the USDHHS, 2000 for some surveys).

The *price elasticity of demand* is a useful concept to quantify by what percentage the quantity demanded is likely to decrease in reaction to a 1 per cent increase in the price. There is a growing consensus among economists that the price elasticity of demand for cigarettes is around -0.4 for developed countries and between -0.4 and -0.8 for developing countries (World Bank, 1999). What this implies is that for every 10 per cent increase in the price of cigarettes, the quantity of cigarettes demanded will decrease by about 4 per cent in developed countries and by between 4 and 8 per cent in developing countries.

A proviso is important. If the average price level in an economy is rising at a rate of, say, 10 per cent, and the price of cigarettes also increase by 10 per cent, then cigarettes have not become *relatively* more expensive. In a case like this, the *real* price of cigarettes has remained the same, despite the fact that the nominal price has increased by 10 per cent. The quantity demanded is not likely to change, because the affordability of cigarettes has not changed. Thus when considering changes in the price of cigarettes one should consider the *real* price, rather than the nominal price.

Through what mechanism does an increase in the real price of cigarettes cause a reduction in the quantity of cigarettes consumed? There are basically three ways:

1. Smokers decide to quit,
2. Current non-smokers decide not to initiate smoking, and
3. Smokers smoke less.

The first mechanism (i.e. smokers deciding to quit) applies mainly to adults, while the second mechanism (i.e. non-smokers not initiating smoking) applies more to

teenagers than adults. The third mechanism (i.e. a reduction in the number of cigarettes smoked by smokers) seems to apply to all smokers. Using data obtained from comprehensive household surveys, researchers in the US, and more recently in a number of East Asian countries have attempted to determine the relative importance of these three mechanisms in using an excise-led price change in decreasing cigarette consumption (Lewit and Coate, 1981, Wassermann, et al, 1991, Chaloupka and Grossman, 1996, Chaloupka and Wechsler, 1997, Mao, et al., 1999, Kyaing, 2003, and Karki, et al., 2003).

There is strong evidence that teenagers are far more price sensitive than adults. In fact, the price elasticity of demand (in absolute terms) of teenagers is about twice that of adults (Chaloupka and Grossman, 1996 and Chaloupka and Wechsler, 1997). The implication for tobacco control is that excise tax increases are thus more effective in preventing teenagers to start smoking, than in causing adult smokers to quit.

The evidence on the strength of the relationship between (1) cigarette price and the probability of smoking and (2) cigarette price and the quantity of cigarettes smoked by smokers is less settled. The empirical evidence from the US suggests that about half of the decrease in cigarette consumption can be ascribed to a reduction in the quantity of smokers (i.e. the probability that a randomly-chosen person smokes decreases), while the other half is ascribed to the fact that the remaining smokers smoke less as a result of the price increase (Chaloupka and Grossman, 1996 and Chaloupka and Wechsler, 1997). In East Asian countries the evidence is mixed, and no clear trends emerge, possibly because the data is less accurate and also because the countries differ one from another (Karki, et al., 2003, Kyaing, 2003, and Arunatilate and Opatha, 2003).

In most countries cigarettes are heavily taxed, often through a variety of taxes. In the European Union the minimum tax on cigarettes is 57 per cent of the retail price, but in some countries, notably the United Kingdom, Denmark and Norway, more than 75 per cent of the retail price is comprised of taxes (Chaloupka, et al., 2000: 239-240).

By increasing the tax on cigarettes the government has a direct impact on the retail price of cigarettes. The empirical evidence indicates that an increase in the excise tax

is fully passed on to consumers. In fact, in the US there is evidence that a given increase in the excise tax (which is levied as a specific tax, i.e. a certain amount per cigarette) increases the retail price of cigarettes by a greater amount than the initial tax increase (see Chaloupka, et al., 2000: 238-242). The tobacco industry, in order to maintain its profitability, has the incentive to make a larger profit per cigarette, in order to compensate for the decrease in the number of cigarettes sold. Because the tobacco industry is highly concentrated in all countries, it has the economic power to do this. In Jamaica, where the tobacco industry is a virtual monopoly, the Cigarette Company of Jamaica would be able to unilaterally increase the retail price by more than the increase in the tax on cigarettes. In South Africa a similar trend is found. Between 1993 and 2002 the *increase* in the real retail price was approximately double the *increase* in the real (specific) excise tax (ETCSA, 2003). Through this strategy, the profit per cigarette increased dramatically. The result of this strategy is that the cigarette industry in South Africa was more profitable in 2002 than in 1993, despite the fact that the quantity of cigarettes sold decreased by about a third over that period. Thus, to summarise this paragraph, by increasing the excise tax on cigarettes, governments can increase the retail price by at least the amount of the tax increase, but more generally the effect of the tax increase is amplified. Of course, this has very positive public health consequences.

The tax can be levied in a number of ways. The two most common methods are a specific tax (a tax levied as a specific amount per cigarette) or an ad valorem tax (a tax levied as a percentage of some specified value). Within these two categories a number of refinements are possible, specifically on how the tax authorities define the base on which they wish to levy the tax. The definition of the tax base has an effect on the likely industry behaviour and the public health outcomes. In Table 3 below a number of methods for levying the tax are shown (the categories are not mutually exclusive), together with the impact that it might have on manufacturers and on public health.

Table 3: Different ways of levying taxes on cigarettes

Tobacco tax	Effect on industry	Public health impact
-------------	--------------------	----------------------

By weight of tobacco	Manufacturers reduce size of cigarettes	Beneficial
By cigarette	Manufacturers increase size of cigarettes	Detrimental
Specific tax	Manufacturers influence is limited, but inflation may erode	Beneficial if high
Ad valorem	Manufacturers keep base level low	Limited benefit
Low tax on non-cigarette products	Smokers switch to substitutes to cigarettes	Limits benefits of the tax
High tax on high tar	Smokers switch to lower tar cigarettes	Slightly beneficial

Source: Townsend, 1996.

While a specific tax has the potential for the highest public health benefit, it suffers from the distinct drawback that it can easily be eroded in times of inflation. Jamaica has had bouts of high inflation in the past, but even moderate inflation will erode the excise tax quite quickly if the government does not adjust the tax rate on a regular basis. In South Africa the real excise tax decreased by 60 per cent between 1980 and 1990, because the government did not regularly adjust the inflation rate in a period when the inflation rate averaged 15 per cent per year (ETCSA, 2003: 52).

Critics of using excise tax increases as a mechanism for tobacco control have argued that the tax falls disproportionately heavily on the poor, implying that the tax is regressive. Regressive taxes are perceived as unfair and socially inequitable. While the empirical evidence shows that this criticism is valid, i.e. the tobacco excise tax is regressive (Townsend, 1987 and Townsend, et al., 1994), tobacco control economists argue that the solution is not a reduction in the excise tax. Quite the opposite. Even though the level of the excise tax is regressive, increases in the excise tax will reduce the degree of regressivity. The explanation lies in the fact that the poor are much more responsive to price changes than the rich (Chaloupka, 1991, Townsend, et al., 1994 Onder, 2002 and Arunatilate and Opatha, 2003). Thus a given increase in the price of

cigarettes will result in a more pronounced decrease in cigarette consumption among the poor than among the rich. The rich are much less likely to give up smoking as a result of an increase in the price of cigarettes than the poor. The net effect is that the absolute burden of the tax (i.e. the tax amount, expressed as a percentage of household income) may increase for both the poor and the rich, but the increase for the rich will be much greater than for the poor.

(b) Income

Other than price, consumers' income is hypothesised to be an important determinant of the demand for any product. Empirical studies on the demand for tobacco, based on time series data, tend to find that income is an important explanatory variable in the demand equation (see survey in Van Walbeek, 2004). Based on time series data, the coefficient in the income variable is practically always positive, indicating that as the average level of income increases, tobacco consumption increases. Thus tobacco is a normal product. However, there is no consensus in the literature on the magnitude of the income elasticity of demand,⁶ other than that it is positive.

The implication of this result is that economic growth has got detrimental tobacco control consequences. Of course, few, if any, would argue that an economy should not be allowed to grow because of the impact that economic growth has on the demand for cigarettes. Nevertheless, this aspect should be borne in mind, especially in countries that are experiencing rapid economic growth. Governments that are serious in curbing the consumption of tobacco can prevent an increase in the demand for tobacco (caused by a growth in average income levels) by making cigarettes less affordable. In order to keep per capita cigarette consumption constant, the government should, by raising the excise tax, cause an increase in the real price of cigarettes using the following formula:

$$\% \Delta P = \% \Delta Y \times \varepsilon_Y / \varepsilon_P$$

6. The income elasticity of demand is defined as the percentage change in the quantity demanded as the result of a one per cent increase in people's (real) income.

where $\% \Delta P$ is the percentage change in real price, $\% \Delta Y$ is the percentage change in per capita income, ϵ_Y is the income elasticity of demand and ϵ_P is the price elasticity of demand.

For example, if per capita income is growing by 5 per cent in real terms, the income elasticity of demand is 0.6 and the price elasticity of demand is -0.5 , then the *real* price would have to increase by 6 per cent to neutralise the impact of the economic growth on tobacco demand.

While the relationship between an increase in income and tobacco consumption is positive in general, empirical studies based on household survey data suggests that the income elasticity of demand can vary quite significantly for different income groups (Van Walbeek, 2004). Overall, empirical studies show that poorer people's tobacco consumption is more sensitive to a change in income than richer people (Nasser, 2003). In fact some studies (see Van Walbeek, 2004) have found that an increase in rich households' income may, in fact, cause a reduction in cigarette consumption. For households like these, cigarettes are inferior products.

(c) *Prices of related products*

There are a number of potential substitutes for cigarettes. In many countries roll-your-own tobacco, pipe tobacco, snuff and cigars are used as substitutes for tobacco. In many Southern and Eastern Asian countries tobacco can be consumed in the form of *bidis*, *kreteks*, and water pipe, to name a few. The relative popularity of these non-cigarette nicotine substitutes is often subject to local customs and traditions. For example, the proportion of roll-your-own cigarettes in total cigarette consumption is much higher in the Netherlands than in other European countries. This difference can not be ascribed to higher than average cigarette prices or lower than average income levels in the Netherlands, vis-à-vis other European countries. It is simply a Dutch peculiarity.

In specifying an empirical demand equation for cigarettes, one should include the price of substitutes in the regression equation, to account for the fact that a change in

the price of a cigarette substitute may have a significant impact on the demand for cigarettes. However, in most econometric studies this is not done. The probable reason is that, because the price of cigarettes is often highly correlated with the price of the cigarette substitute, the regression equation suffers from an unacceptably high degree of multicollinearity. The result is that the highly correlated variable (i.e. the price of the cigarette substitute) gets excluded from the equation.

Intuitively, it is plausible that people will shift to cheaper substitutes if their cigarettes become unaffordable. These substitutes can either be cheaper brands or alternative products like *bidis* or roll-your-own tobacco. A study on the smoking behaviour of different income groups in South Africa has clearly shown that the poorest 25 per cent of the population have dramatically reduced their consumption of cigarettes in reaction to sharp increases in the price of cigarettes since the mid-1990s. However, there has been a sizeable increase in the consumption of roll-your-own tobacco among these poor households, although not so large as to neutralise the rapid decrease in the consumption of cigarettes (Van Walbeek, 2004).

The policy implications that follow from this discussion are quite clear. When the government decides to increase the excise tax on cigarettes, it should increase the tax rate on cigarette substitutes as well. Given that the price of the substitutes, even after the across-the-board tax increase, will be lower than the price of cigarettes, some substitution is inevitable, but at least the effect is minimised.

One could argue that there are possibly complements to tobacco as well. Research by Jimenez and Labeaga (1994) suggests that there is a close correlation between tobacco and alcohol consumption. Their research suggests that increases in the tax on *alcohol* may reduce *tobacco* consumption. However, the causality in their analysis is not clear, and the correlation could possibly be spurious. Nevertheless, in future studies this aspect may become more important.

(d) *Tastes and preferences*

Although tastes and preferences are generally regarded as important determinants of the demand for a product, they are generally very difficult to model empirically. In

practically all developed countries and in many developing countries smoking has become increasingly socially unacceptable among many people. There are a number of reasons for this: the greater awareness of the harmful impact of environmental tobacco smoke, greater awareness about the overall medical impact of smoking, active lobbying of non-smokers' rights associations for smoke-free air, and the vilification of the tobacco industry, through, amongst others, the filming of *The Insider* and the publication of incriminating industry documents in the popular press and on the Internet, etc.

In empirical work it is very difficult, if not impossible, to distinguish the impact that changing tastes have on the demand for cigarettes, *separate* from other influences. Studies that incorporate tastes and preferences in their regression equations tend to use a time trend, and assume, rather heroically, that tastes and preferences change slowly but consistently over time (Townsend, 1987, Stewart, 1993b, and Onder, 2002). While this is not very satisfactory, the fact of the matter is that there are usually no better alternatives, other than ignoring tastes and preferences altogether.

(e) *Legislative interventions*

Legislative interventions can take a number of forms, the common ones being the following:

- Restricting smoking in public and work places,
- Restricting the advertising of tobacco and/or sponsorships by tobacco companies (see following section),
- Printing health warnings on the packets, and
- Regulating and disclosing the contents of tobacco products.

Studies in the US have found that legislation aimed at restricting smoking in public areas (e.g. shopping malls, restaurants and bars) have had a significant impact on the overall smoking prevalence in places where such laws were enforced (see survey in Chaloupka and Warner, 199: 37). However, the magnitude of the impact of this intervention on cigarette consumption is nevertheless modest in comparison to, for example, a sizeable increase in the excise tax.

Experience from around the world has shown that measures aimed at restricting smoking in public places and restricting/banning advertising attracts ferocious opposition from the industry. The tobacco industry and related industries (mainly the hospitality industry) fear that restrictions on smoking in public places will seriously harm the hospitality industry. Studies sponsored by the tobacco industry on the likely impact of such restrictions on the hospitality industry generally paint a very gloomy picture.⁷ However, an ex post study by Glantz and Charlesworth (1999) found that the hospitality industry is either unaffected by such restrictions, or may even be positively affected.

Most countries require the tobacco-manufacturing firms to print health warnings on their packaging and advertising material (where advertising is allowed). The size and wording of these warnings differ from country to country. Recently Canada and Brazil have passed legislation forcing the tobacco industry to place pictorial warnings on the packaging and including a detailed description on the way that smoking impacts health, rather than having a rather bland warning like “Smoking causes cancer” or “Smoking seriously harms your health”. According to Murray Kaiserman, who was involved in implementing the new regulations in Canada, public knowledge on the medical impact of tobacco has improved dramatically as result of these new warnings (personal communication). However, as yet the impact that these pictorial warnings have had on the quantity of cigarettes smoked in Canada and/or Brazil has not been established.

Empirically it is difficult to establish the magnitude of the impact of certain legislative interventions on the demand for tobacco. Where estimates of these magnitudes have been obtained, these are generally quite modest, as mentioned above. Does this mean that they are not worth pursuing? Certainly not.

7. For example, when the legislation on smoke-free restaurants was debated in South Africa in 1998, the hospitality industry claimed that restaurants would lose as much as 38 per cent of their revenues as a result of this legislation, based on a survey that was done by the industry body (see Malan and Leaver, 2003, for a good chronology of the imposition of tobacco control interventions in South Africa, and the debates that took place between pro- and antagonists).

Even though the impact of tobacco control legislation on the demand for tobacco is limited in econometric studies, the main contribution of such legislation is that it changes societal norms and customs. It helps to denormalise tobacco. Legislation that prohibits smoking in public places (and also workplaces) has a significant effect on property rights.⁸ Before the legislation is passed smokers have the right (implicitly or explicitly) to pollute the air with their tobacco smoke. The legislation explicitly gives non-smokers the right to tobacco-free air. Such legislation does not require an “anti-smoking police force” to enforce the legislation. All that is required is that smokers and non-smokers are aware of the legislation, that appropriate signage is placed in public buildings, and that non-smokers point out to smokers that it is illegal to smoke, if infringements do take place. Few smokers will flaunt the legislation if there is a social consensus that smoking in enclosed public areas is not allowed.

Consider the following example. In South Africa the Minister of Health introduced strong tobacco control legislation that included a ban on smoking in public and workplaces in 1998. The tobacco industry vehemently opposed the legislation, arguing that it would be unenforceable, that hospitality establishments should decide their own smoking policies and that the legislation was unconstitutional. Despite the protests the legislation was passed and became effective in 2001. Smoking in public places has all but disappeared. The only places where some people still smoke (against the law) are in bars. Smokers have generally accepted the legislation and the degree of compliance is very high. Non-smokers have the benefit of not being exposed to tobacco smoke. A large-scale crackdown on smokers, predicted by the industry, was not necessary, because social pressure, and the fact that property rights had been well established (and were not subject to “good manners” by smokers and/or the “putting up with the cigarette smoke” by non-smokers), ensured that smokers willingly complied to the legislation.

8. Property rights have a specific meaning in economics. For privately owned goods (not necessarily fixed property only) the owner has the *property right* to those goods, and can do with those goods what he pleases, e.g. rent it out, use it, sell it and even destroy it. For goods that are not privately owned (i.e. belonging to “the community”), like the air around us, parks, mountains, rivers, beautiful views, etc. the issue of property rights is more complex. Has someone got the right to pollute the air and/or rivers? Can someone build a large building in front of someone else’s building and thus ruin the latter’s view? The property rights to such communal properties, unless legislated, are thus potentially open to conflicting claims.

Other than a study that investigated the relationship between anti-smoking sentiment and restrictions on smoking in a variety of public places (Chaloupka and Saffer, 1992), no study, to the authors' knowledge, has specifically investigated the impact of the changing social climate and societal norms on the demand for tobacco. A comprehensive strategy, consisting of strong tobacco control legislation, education and publicity, and rapidly increasing excise taxes, is likely to be more effective than a fragmented approach. It seems plausible that the effects of the various interventions (i.e. consistent increases in the real tax on cigarettes, together with appropriate and comprehensive legislation) are amplified when a comprehensive strategy is employed.

(f) Restrictions on advertising

In many countries cigarettes are some of the most advertised products. In fact, until recently, cigarette brands were regarded as some of the most recognised and valuable brands in the world.

Does cigarette advertising increase the sales of cigarettes? According to tobacco control economists the answer is a clear yes. They argue that the tobacco industry has a clear incentive to advertise their product. Firstly, they can present an "adult activity" to teenagers as a socially desirable thing to be involved in. By advertising, the tobacco industry can play on teenagers' insecurities and "trick" them into a habit, which they later regret they started. Secondly, advertising is inherently misleading, in which a deadly product is presented as glamorous, socially acceptable and normal. Thirdly, given the amounts of money involved in cigarette advertising, it must be effective; otherwise firms would not do it.

On the other hand the tobacco industry argues that they do not advertise to "lure" teenagers into smoking, but to maintain existing smokers' brand loyalty or to persuade smokers of other brands to switch brands. Of course this argument wears thin when the cigarette market is dominated by a monopoly or near-monopoly, as is the case in many developing countries.

Unfortunately the empirical evidence does not provide much guidance. A sizeable empirical literature on the relationship between tobacco advertising and the demand

for tobacco products exists, but this literature is not conclusive (Chaloupka and Warner, 1999: 30-34). The gulf between the “tobacco control position” and the “industry position” is huge and insurmountable. Studies that indicate that advertising expenditure has a significant impact on total cigarette demand are often severely criticised by tobacco industry researchers, sometimes justifiably, but more often out of principle, rather than substance (see, for example, Stewart, 1992 and 1993a, Duffy, 1996 and High, 1999).⁹

However, even studies that find that advertising expenditure has a significant positive impact on cigarette expenditure, the impact is usually not all that large. For most studies the econometric evidence suggests that a ban on advertising would reduce cigarette consumption by about 6 per cent or less (Chaloupka and Warner, 1999: 30-34).

The fact that there is no consensus in the econometric literature on the relationship between tobacco advertising and tobacco demand has resulted in an alternative theoretical explanation about the relationship between these two variables (Saffer and Chaloupka, 2000). If one assumes that advertising expenditure is subject to diminishing returns, it follows that the last ten per cent of advertising expenditure is much less effective than the first ten per cent. Given that most econometric studies focus on time series data, where the differences between the various years are often not large, it follows that econometric analysis is not likely to “pick up” the effect of a change in tobacco advertising on tobacco consumption. The fact that a marginal change in advertising expenditure does not have a significant effect on overall consumption does not imply that a large change in advertising expenditure will also not have an insignificant impact on consumption.

9. The best example of “academic mud slinging” is Stewart’s (1992) criticism of Laugesen and Meads’s (1991) analysis of the advertising-consumption debate in the OECD countries, and the ensuing debate (Stewart, 1993a, and Laugesen and Meads, 1993). Stewart, in trying to discredit Laugesen and Meads’s analysis, nitpicked their data and methodology, without showing what the impact would be on the results obtained. In a subsequent paper, Stewart (1993b) used essentially a similar approach to find an opposite result. Given the amount of effort that Stewart put into his criticism of Laugesen and Meads, it is surprising that in his “alternative analysis” seems very sloppy to a casual reader of his paper. This acrimonious debate illustrates the seriousness that the industry places on research that finds a positive relationship between advertising expenditure and tobacco consumption. It also illustrates the more general point that the industry will do everything in its power to create dissenting and alternative views on issues that it regards as important.

Using cross-section data for a number of developed countries, Saffer and Chaloupka (2000) found that countries that have imposed comprehensive bans on advertising and sponsorship experienced far more pronounced decreases in tobacco consumption than countries that employed only partial bans. In fact, there is consensus among tobacco control economists that partial advertising bans are not all that successful in reducing tobacco consumption, because the industry will simply circumvent the partial bans (World Bank, 1999: 50).

(g) Health publicity

The first medical and epidemiological reports that linked smoking to lung cancer were published in the 1930s and 1940s. The Royal College of Physicians report of 1962 and the US's Surgeon-General report of 1964 were the first comprehensive and well-publicised reports on the dangers of smoking. Since then tens of thousands of studies have investigated the relationship between smoking and a variety of illnesses and diseases.

In reaction to these reports, many developed countries have implemented a number of tobacco control measures, amongst other a health publicity drive. A number of studies have investigated the impact that the publicity created by the publication of the 1962 and 1964 reports had on cigarette consumption in the UK and US respectively (Sumner, 1971, Atkinson and Skegg, 1973, Peto, 1974, Witt and Pass, 1981 and Townsend, 1987). Generally these “health scares” have resulted in a decrease in tobacco consumption, but the effect seems to have been transitory, in that tobacco consumption gradually moved back to the pre-report levels, holding other factors constant (Atkinson and Skegg, 1973 and Witt and Pass, 1981).

4.2 *The demand for cigarettes in Jamaica: a multiple regression approach*

In section 2 two scatter plots were shown that indicated a positive relationship between cigarette consumption and per capita GDP and a negative relationship between cigarette consumption and the real price of cigarettes. The aim of this section is to estimate the magnitude and strength (i.e. statistical significance) of the

relationship between the demand for cigarettes in Jamaica and those factors that determine it.

Despite the fact that there have been major advances in both theoretical and applied econometric techniques in the past decades (see, for instance Harris, 1995), a more modest approach at estimating the demand for cigarettes is used in this study, given the limited quantity of data and the potential for data errors in these data. In the context of this study, using advanced techniques on data that may be subject to measurement and other errors will probably result in an image of sophistication that is unjustified. A standard ordinary least squares (OLS) approach is used, and a number of specifications will be presented, that will indicate the relationship between the demand for cigarettes and various combinations of independent variables.

The primary aim of this section is to estimate the price elasticity of demand for cigarettes. A secondary aim is to investigate the income elasticity of demand. As was pointed out in section 4.1, the international literature indicates that these two factors are by far the most important determinants of the demand for tobacco. The demand equations will be estimated in both aggregate and per capita terms. Where appropriate, a lagged dependent variable will be included in the regression equation. This allows one to investigate the magnitude of the short- and long-run price elasticities of demand, respectively.¹⁰ Also, the mathematical form of the regression equation is specified in both linear and loglinear form. For the linear specification, the coefficients have little meaning in themselves (other than indicating a positive or negative relationship), but the elasticities can easily be calculated. The standard approach is followed and the elasticities are calculated at the means. For the loglinear specification, the coefficients are interpreted as (constant) elasticities.

In total eight specifications have been specified and estimated. The regression output is presented in the Appendix, while the summarised results are shown in Table 4.

10. Given an equation $\ln Q_t = \alpha + \beta_1 \ln Q_{t-1} + \beta_2 \ln P_t$, the short-run price elasticity of demand is β_2 , while the long-run price elasticity of demand is $\beta_2/(1 - \beta_1)$, with $0 < \beta_1 < 1$.

Equation	Mathematical form	Aggregate/per capita consumption	Short-run price elasticity	Long-run price elasticity	Significance of short-run price elasticity	Income elasticity	Significance of income elasticity
(1)	Loglinear	Aggregate	-0.48	na	$P < 0.001$	0.01	$P = 0.98$
(2)	Linear	Aggregate	-0.47	na	$P < 0.001$	0.01	$P = 0.94$
(3)	Loglinear	Aggregate	-0.22	-0.38	$P < 0.05$	-0.05	$P = 0.70$
(4)	Linear	Aggregate	-0.22	-0.37	$P < 0.05$	-0.05	$P = 0.70$
(5)	Loglinear	Per capita	-0.98	na	$P < 0.0001$	0.51	$P < 0.1$
(6)	Linear	Per capita	-0.80	na	$P < 0.0001$	0.89	$P < 0.005$
(7)	Loglinear	Per capita	-0.23	-0.97	$P < 0.2$	-0.05	$P = 0.83$
(8)	Linear	Per capita	-0.18	-0.73	$P = 0.23$	-0.03	$P = 0.89$

Note: a low P value ($P < 0.1$) indicates that the coefficient is statistically significant.

A number of observations can be made about Table 4. Firstly, the specification of the regression equation has a very pronounced effect on the results that are obtained. It would be unscientific and misleading to say that “the price elasticity is x ”, because any deviation in the specification on which this statement is based would result in a very different price elasticity estimate. Thus rather than presenting only one price elasticity estimate, a number are presented. Secondly, despite the fact that the price elasticity estimates are heavily dependent on the specification of the regression equation, there is strong and consistent evidence that the price elasticity (1) is statistically significant and (2) has a value of between 0 and -1 , i.e. the demand for cigarettes is price inelastic, but is certainly not perfectly inelastic.¹¹ Thirdly, where long-run elasticities of demand are calculated, they are between 1.8 and 4 times the absolute magnitude of the short-run elasticities. However, even in the long run, there is no evidence that the price elasticity of demand is greater than one in absolute terms. Fourthly, with the exception for two specifications (equations 5 and 6), the income elasticity of demand is generally small and insignificant. This suggests that changes in income (in these specifications approximated by changes in the real GDP) have not had a significant impact on the demand for cigarettes in Jamaica. This result is at odds

¹¹. Where a lagged dependent variable is included in the regression equation (which is necessary to calculate the long-run elasticity of demand), the statistical significance of the price variable is diminished. The primary reason for this is that the lagged dependent variable tends to dominate the regression equation (see the R^2 values in the Appendix), which means that all other independent variables tend to be “overwhelmed” and lose their statistical significance.

with the bulk of the international literature, which found a positive relationship between income and the demand for cigarettes (see section 4.1 (b)).

5. IMPACT OF A TAX CHANGE ON CIGARETTE CONSUMPTION AND GOVERNMENT REVENUE

The previous section indicated that

- (1) the estimate for the price elasticity of demand is sensitive to the specification of the regression equation,
- (2) the real price of cigarettes is an important and statistically significant determinant of the demand for tobacco,
- (3) the short-term price elasticity of demand lies between -0.2 and -1.0 , although most specifications suggest an elasticity estimate in the lower, and
- (4) the long-term price elasticity, where estimated, is between 1.8 and 4 times greater than the short-term price elasticity.

The aim of this section is to use perform some sensitivity analyses, based on the current situation in Jamaica, to establish the likely impact of a change in the cigarette tax on (1) cigarette consumption, and (2) total government revenue from cigarette taxes.

The analysis is based on the following assumptions:

- (1) The situation in 2001 is taken as the base scenario (more recent data are not available). The price per pack of cigarettes is J\$ 122, the average tax per pack is J\$ 51.95 (resulting in an average tax burden of 42.6 per cent), aggregate consumption is 53.17 million packs, and government revenue from cigarettes is J\$ 2762.1 million.
- (2) The real retail price consists of two components: tax and the remainder, which, for lack of a better word, will be called the “industry price”,
- (3) When the real cigarette tax increases, it is assumed that the real industry price is unaffected by the change in the tax.¹² The implication of this assumption is

12. However, as discussed in section 4.1 (a), this is not always the best assumption to make, because the tobacco industry may have an incentive to increase the real retail price by more than the increase in the real amount of the tax. Should this happen, the benefit to the Ministry

that the supply curve is perfectly elastic. Thus the increase in the tax is borne exclusively by the consumers, not the tobacco industry,

- (4) In this example the real cigarette tax (i.e. the amount of tax per pack of cigarettes) is assumed to increase by 10 per cent. Should the increase be more or less than 10 per cent, the magnitudes of the changes in cigarette consumption and government income will change, but the changes will be proportional to the change in the real cigarette tax.

By increasing the real cigarette tax by 10 per cent, the average tax per pack increases from J\$ 51.95 to J\$ 57.14. On the assumption that the real “industry price” is not affected by this change in the tax, the retail price will increase from J\$ 122 to J\$ 127.20.

The interesting issue is what will happen to cigarette consumption and government revenue. Of course this depends crucially on the estimated value of the price elasticity of demand. Rather than using an arbitrary value, the results of a number of simulations, in which different price elasticities of demand are used, are shown in Table 5.

Table 5: Simulation results

	Impact of a 10 per cent increase in the cigarette tax, given different price elasticities of demand		
Price elasticity of demand	Percentage change in aggregate cigarette consumption	Percentage change in government revenue	
(1)	(2)	(3)	
0.0	0.00	10.00	
-0.1	-0.43	9.53	
-0.2	-0.85	9.06	
-0.3	-1.28	8.59	
-0.4	-1.70	8.13	
-0.5	-2.13	7.66	
-0.6	-2.55	7.19	
-0.7	-2.98	6.72	
-0.8	-3.41	6.25	
-0.9	-3.83	5.78	

of Finance will be decreased to some degree, because the additional price increase (over and above the increase in the amount of the tax) will cause an additional reduction in the quantity consumed that is not explained by the increase in the amount of the tax. However, the public health benefit will be amplified, because people are going to cut back their cigarette consumption by more than what the tax-induced price increase would have achieved by itself.

-1.0	-4.26	5.32	
-1.1	-4.68	4.85	
-1.2	-5.11	4.38	
-1.3	-5.54	3.91	
-1.4	-5.96	3.44	
-1.5	-6.39	2.97	

In Table 5 the price elasticities range between 0 (i.e. perfectly inelastic) and -1.5 (i.e. relatively elastic). Given the regression results in the previous section and the vast empirical literature that was touched on in section 4.1, it is most probable that the true value of the price elasticity of demand is in this range. The likely range for the true value of the price elasticity of demand is between -0.3 and -0.6 .

Table 5 clearly illustrates the fact that if the price elasticity of demand is low in absolute terms, the impact of an increase in the tax on consumption will be limited, but the impact on government revenue will be large. On the other hand, if the demand for the product is relatively price elastic, an increase in the tax will result in a sharp decrease in consumption, but the increase in government revenue will be less pronounced. However, Table 5 clearly indicates that for any price elasticity of demand for cigarettes between 0 and -1.5 an increase in the tax on cigarettes will result in a decrease in tobacco consumption and an increase in government revenue. There is no trade-off. The interests of both the Ministry of Finance and the Ministry of Health are served. The only “trade-off” is to determine the relative magnitudes of the gains to be achieved by the two ministries. All else the same, the Ministry of Health would want the price elasticity to be high, because a given increase in the tax will then cause a larger decrease in smoking. On the other hand, the Ministry of Finance might wish for a lower price elasticity, because this would mean that a given increase in the tax would result in a relatively greater increase in government revenue.

Can the government increase the tax on cigarettes indefinitely? Presumably not. However, given Jamaica’s current cigarette tax burden of less than 45 per cent, there is ample room for a significant increase in the tax burden. Some simulations are shown in Table 6. In this table the impact of an increase in the tax burden on cigarettes is shown for the following: the retail price of cigarettes, consumption of cigarettes, and government revenue. This table is compiled on the assumption that the price elasticity of demand is -0.5 , and that the industry keeps the real industry price at

the same level. As was discussed in a previous footnote, should the industry decide to increase the industry price in line with the increase in the tax the public health benefit will be enhanced, while the government revenue benefit will be tempered from the values shown in Table 6.

Table 6 suggests that the government of Jamaica can increase its revenues from cigarettes by more than 70 per cent if it increases the tax burden from the current level of 42 per cent to around 67.5 per cent. The public health implication of such a move would be immense. Tobacco consumption would decrease by nearly 40 per cent from current levels. Cigarette prices would increase by about 77 per cent in real terms.

Is such a high tax burden realistic and sustainable? If one considers the experience of other countries, this clearly seems to be the case. In countries like the UK and some Scandinavian countries the government has imposed taxes as high as 75 per cent of the retail price (Chaloupka, et al., 1999: 239-240). In fact, the *minimum* tax burden on cigarettes in the European Union is currently 57 per cent of the retail price.

Should Jamaica decide to impose a cigarette tax equal to the minimum EU tax, it would have to increase the current tax by 79 per cent, again assuming that the tobacco industry will keep the real industry price constant. Assuming a price elasticity of -0.5 , the result of such a tax increase would be to decrease cigarette consumption by 16.9 per cent and increase real government revenue by 49 per cent.

Table 6: Implications of raising the tax on cigarettes

Tax burden (tax as percentage of retail price)	Percentage change in the tax per pack of cigarettes	Predicted retail price (in constant 2001 prices)	Percentage change in cigarette consumption	Percentage change in government revenue
45.0	10.3	127	-2.2	7.91
47.5	22.0	133	-4.7	16.29
50.0	34.9	140	-7.4	24.85
52.5	49.0	147	-10.4	33.48
55.0	64.8	156	-13.8	42.07
57.5	82.4	165	-17.6	50.42
60.0	102.3	175	-21.8	58.23
62.5	124.8	187	-26.6	65.06
65.0	150.4	200	-32.0	70.23
67.5	180.1	216	-38.3	72.70
70.0	214.7	234	-45.7	70.86

72.5	255.5	255	-54.4	62.12
75.0	304.6	280	-64.8	42.24

Note: it is assumed that the real industry price is unaffected. All percentage changes are taken from the base situation in 2001

Table 6 does not necessarily suggest a “big bang” once-off tax increase. A phased approach can be equally successful. In South Africa the government phased in the tax increases over a period of four years. Between 1994 and 1998, when the government-set target of 50 per cent tax burden was achieved in South Africa, the real retail price had increased by 57 per cent, aggregate cigarette consumption had decreased by 15 per cent, per capita consumption had decreased by 20 per cent and real government revenue from tobacco taxes had increased by 75 per cent (ETCSA, 2003: 52).

If tobacco control is an important policy and public health goal, the government of Jamaica would do well to announce “tax burden target” and take active steps to achieve the target within a number of years.

6. POSSIBLE CONCERNS

From an economic point of view, the policy prescriptions for an effective tobacco control strategy are clear-cut. Of all the interventions available, and there are many, as was discussed in section 4.1 (a), by far the most effective *and* most cost-effective intervention is an increase in the tax on cigarettes. The experiences of other countries and the simulation exercises presented in this paper clearly indicate that an increase in the tax on cigarettes will reduce the consumption of cigarettes and will increase government revenue. It is a win-win situation; there is no trade-off.

However, the crucial element is the political will to stand against the vested interests of the tobacco industry. International experience has shown that the tobacco industry will aggressively fight any intervention that will reduce their profitability. The tobacco industry will say that they support “sensible legislation” and interventions like educational campaigns to warn school children against the dangers of smoking. While one should not dismiss such educational campaigns out of hand, the fact of the matter is that such campaigns are not nearly as effective in curbing smoking compared to interventions such as clean indoor air legislation, advertising bans and

tax increases. As a rule of thumb, the more vigorously a tobacco control intervention is opposed by the tobacco industry, the more effective that intervention is likely to be.

The industry will typically fight an increase in tobacco taxation on the following grounds:

- a) It will stimulate the smuggling of cigarettes;
- b) The decrease in consumption will result in a decrease in government revenue;
- c) Jobs will be lost; and
- d) The increased tax will hurt the poor, because smoking prevalence is generally higher among the poor than the rich.

While all these concerns have an element of truth, they do not nullify the policy proposal made in this paper. In the following sections these concerns will be analysed in more detail.

a) Smuggling issues

There is some evidence that differences in prices between states (especially in the US) and countries (e.g. between France and the UK) encourages some people to bootleg cigarettes from the low-price area to the high-price area. However, this is not the main problem. The far more serious issue concerns the smuggling of large quantities of untaxed cigarettes by crime syndicates. Often these cigarettes are exported tax-free, only to be smuggled into the original exporting country.

While certainly not all cigarette smuggling is orchestrated by the tobacco industry, there is substantial evidence that the tobacco industry has been actively involved in the smuggling of cigarettes. Internal documents by the industry clearly indicate that the industry was often aware of smuggling activities and, in fact, often played an active role in smuggling in order to open up new markets (see Hammond and Rowell, 2001).

The solution to the smuggling problem is not a reduction in tax rates, but better law enforcement. This is one of the key recommendations of the Framework Convention for Tobacco Control.

b) *A decrease in government revenue?*

It is true that if tobacco disappears completely, then government revenue from the taxation of tobacco will decrease to zero. While this might be the long-term public health aim, this is clearly not going to happen overnight. In fact, given the addictive properties of nicotine, cigarettes will be around for at least the next 50 years, simply because some people are unable to quit.

Even in areas where a variety of stringent anti-smoking measures have been in place for a long time, such as British Columbia, California and New York State, smoking prevalence is still above 15 per cent. This suggests that there is some “threshold percentage” of smokers that would continue to smoke, despite all the tobacco control interventions. The tobacco industry will certainly not disappear, even if taxes are increasing rapidly, despite the industry’s claims that the taxes are excessive and will eventually lead to a decrease in government revenue.

c) *Employment issues*

The comment is often made that the cigarette tax increase will cause a decrease in employment. While this statement sounds plausible at first, it focuses on only one sector of the economy, namely the tobacco sector. It is true that a large reduction in the demand for tobacco is likely to result in jobs being lost in the tobacco sector.

However, an important aspect, and one that the tobacco industry does not emphasise, is that the money that was previously spent on tobacco products does not disappear from the economy, but is used to buy other goods and services. The increased demand for such goods and services will increase the demand for labour in these sectors. Unfortunately it is virtually impossible to say precisely which jobs have been created because of consumers switching away from tobacco to other goods and services. However, a number of studies (see survey in Van der Merwe, 1998b: 203-206) have used macroeconomic models, input-output tables and social accounting matrices to investigate what would happen to overall employment should the tobacco sector disappear and people divert their expenditure to other goods and services. They all

found that overall employment would be enhanced because the more people would be employed in other sectors of the economy than the number of employment opportunities that are lost in the tobacco and related industries. The reason is quite intuitive: relative to other industries the tobacco industry is more capital intensive. The goods and services to which ex-smokers would shift their expenditure are relatively more labour intensive, which means that the gains in employment in these industries exceed the loss of employment in the tobacco and related sectors

d) Do taxes hurt the poor?

It could be argued that increasing the tax on cigarettes will hurt the poor because, firstly, the poor tend to smoke more than the rich, and secondly, the poor spend a relatively higher percentage of their disposable income on tobacco products than the rich. This implies that the tax on cigarettes is regressive, i.e. the tax burden is heavier on the poor vis-à-vis the rich. While this is generally not disputed, tobacco control economists would argue that the solution to the regressivity of the tax on cigarettes is not to decrease the tax, but rather to increase it. As was pointed out in section 4.1 (a) there is ample empirical evidence to indicate that the poor are generally more price sensitive than the rich, and would thus reduce their consumption by a greater percentage in reaction to a given increase in the tax.

The implication is that an increase in the tax on cigarettes decreases the degree of regressivity. Also, by cutting back on their smoking, the poor reduce their risk of incurring a range of diseases, each of which carries a high cost, specifically in terms of increasing the smokers' morbidity and mortality risk.

7. CONCLUSION

The aim of this paper was to investigate the economics of tobacco control in Jamaica. Despite the fact that tobacco consumption has been decreasing consistently over the past 30 years, this paper pointed out that increases in the tax on tobacco would decrease cigarette consumption further and result in a significant increase in government revenue.

It was impossible to obtain a precise estimate of the price elasticity of demand, but all econometric specifications indicate that the price elasticity for cigarettes is relatively inelastic, but certainly not perfectly inelastic. Given the current cigarette tax regime and the price elasticity estimates, an increase in the tax on cigarettes will result in a decrease in cigarette consumption and an increase in government revenue. In fact, should the government of Jamaica decide to increase the tax by 10 per cent, consumption is likely to decrease by X per cent and government revenue will increase by Y per cent.

The analysis indicates that the government can increase its revenues by raising the tax burden to about 67.5 per cent of the retail price. Given the current tax burden of about 42 per cent, this gives the government of Jamaica much scope to increase the cigarette tax.

An increase in the tax on cigarettes is by no means the only way to reduce cigarette consumption. A number of additional methods exist, such as a ban on advertising, restrictions on smoking in public places, more awareness of the risks associated with smoking, restrictions on the tar and nicotine content, etc. However, none of these legislative interventions are as potent as an increase in the tax.

However, despite the clear economic benefits of increasing the tax on cigarettes, many governments are slow to change their tax policies, often because of pressure exerted by the industry. The arguments that the industry presents are often flawed and can be easily countered. The single most important ingredient in an effective tobacco control strategy is the political will to stand against a powerful and influential industry. It is hoped that this study will persuade the Ministries of Health and Finance that they fight a common cause by increasing the tax on cigarettes.

BIBLIOGRAPHY

1. Arunatilake, N and Opatha, M, 2003. "The economics of tobacco in Sri Lanka". Economics of Tobacco Control Paper No. 12, Health, Nutrition and Population Discussion Paper Series. Washington, DC: World Bank.

2. Atkinson, AB and Skegg, JL, 1973. "Anti-smoking publicity and the demand for tobacco in the UK". *The Manchester School of Economic and Social Studies*, 41: 265-282.
3. Chaloupka, FJ and Grossman, M, 1996. *Price, Tobacco Control Policies and Youth Smoking*. Working Paper 5740, National Bureau of Economic Research, Cambridge, MA: NBER.
4. Chaloupka, FJ and Saffer, H, 1992. "Clean indoor air laws and the demand for cigarettes". *Contemporary Policy Issues*, 10(2): 72-83.
5. Chaloupka, FJ and Warner, KE, 1999. *The economics of smoking*. Working Paper 7047, National Bureau of Economic Research, Cambridge, MA: NBER.
6. Chaloupka, FJ and Wechsler, H, 1997. "Price, tobacco control policies and smoking among young adults". *Journal of Health Economics*, 16: 359-373.
7. Chaloupka, FJ, 1991. "Rational addictive behaviour and cigarette smoking". *Journal of Political Economy*, 99(4): 722-742.
8. Chaloupka, FJ, Hu, T, Warner, KE, Jacobs, R and Yurekli, A, 1999. "Chapter 10: The taxation of tobacco products", in Jha and Chaloupka (eds.). *Tobacco Control in Developing Countries*. New York: OUP: published by Oxford University Press on behalf of The World Health Organisation and The World Bank.
9. Chaloupka, FJ, Jha, P and Peck, R, 1998, "A framework for cost-benefit analysis", in Abedian et al. (eds.). *The Economics of Tobacco Control: Towards an Optimal Policy Mix*. Cape Town: AFReC, University of Cape Town.
10. *Economics of Tobacco Control in South Africa Project (Phase 2)*, 2003. *The economics of tobacco control in South Africa*. Cape Town, Applied Fiscal Research Centre.
11. Gajalakshmi, CK, Jha, P, Ranson, K and Nguyen, S, 2000. "Chapter2: Global patterns of smoking and smoking-attributable mortality" in Jha and Chaloupka (eds.). *Tobacco Control in Developing Countries*. New York: OUP: published by Oxford University Press on behalf of The World Health Organization and The World Bank.
12. Hammond, R and Rowell, A, 2001. *Trust us, we're the tobacco industry*. Report published by Campaign for Tobacco-free Kids and Action on Smoking and Health. Accessible at <http://www.ash.org.uk/html/conduct/html/trustus.html>
13. Harris, RID, 1995. *Using Cointegration Analysis in Econometric Modelling*, London: Prentice Hall.
14. Jha, P, Musgrove, P, Chaloupka, FJ and Yurekli, A, 1999. "Chapter 7: The economic rationale for intervening in the tobacco market", in Jha and Chaloupka (eds.). *Tobacco Control in Developing Countries*. New York: OUP: published by Oxford University Press on behalf of The World Health Organisation and The World Bank.
15. Jimenez, S and Labeaga, JM, 1994. "Is it possible to reduce tobacco consumption via alcohol taxation?" *Health Economics*, 3: 231-241.
16. Karki, YB, Dev Pant, K and Raj Pande, B, 2003. "A study on the economics of tobacco in Nepal". *Economics of Tobacco Control Paper No. 13*, Health, Nutrition and Population Discussion Paper Series. Washington, DC: World Bank.
17. Kyaing, NN, 2003. "Tobacco economics in Myanmar". *Economics of Tobacco Control Paper No. 14*, Health, Nutrition and Population Discussion Paper Series. Washington, DC: World Bank.
18. Laugesen, M and Meads, C, 1991. "Tobacco Advertising Restrictions, Price, Income and Tobacco Consumption in OECD Countries, 1960-1986", *British Journal of Addiction*, 86(10): 1343-54.
19. Laugesen, M and Meads, C, 1993. "The authors' reply to 'Tobacco consumption and advertising restrictions: A critique of Laugesen and Meads (1991)' by M.J. Stewart". *International Journal of Advertising*, 12: 75-80.
20. Lewit, EM and Coate, D, 1981. *The potential for using excise taxes to reduce smoking*. Working paper 764. Cambridge, MA: NBER.

21. Malan, M and Leaver, R, 2003. "Political change in South Africa: New tobacco control and public health policies", in De Beyer, J and Waverley Brigden, L, Tobacco control policy: Strategies, successes & setbacks. Washington and Ottawa: Copublication of the World Bank and Research for International Tobacco Control.
22. Mao, Z, Hsieh, C, Hu, T and Jiang, J, 1999. The demand for cigarettes in China. Mimeo.
23. Onder, Z, 2002. "The economics of tobacco in Turkey". Economics of Tobacco Control Paper No. 2, Health, Nutrition and Population Discussion Paper Series. Washington, DC: World Bank.
24. Peck, R, Chaloupka, FJ, Jha, P and Lightwood, J, 1999. "Chapter 6: A welfare analysis of tobacco use", in Jha and Chaloupka (eds.). Tobacco Control in Developing Countries. New York: OUP: published by Oxford University Press on behalf of The World Health Organisation and The World Bank.
25. Peto, J, 1974. "Price and consumption of cigarettes: a case study for intervention". British Journal of Preventative and Social Medicine, 28: 241-245.
26. Prince, LA, 2003. Impact of tobacco reduction measures on the Jamaican economy: Economic analysis of the proposed measures for the prevention and control of tobacco use. Unpublished report written for the Ministry of Health.
27. Saffer, H and Chaloupka, FJ, 2000. "The effect of tobacco advertising bans on tobacco consumption." Journal of Health Economics, 19: 1117-1137.
28. Shibuya, K, Ciercierski, C, Guindon, E, Bettcher, D, Evans, DB, and Murray, CJL, 2003. "WHO Framework Convention on Tobacco Control: development of an evidence-based global public health treaty". British Medical Journal, 327: 154-157.
29. Stewart, MJ, 1992. "Tobacco consumption and advertising restrictions: A critique of Laugesen and Meads (1991)". International Journal of Advertising, 11: 97-118.
30. Stewart, MJ, 1993a. "Comment on the authors' reply to 'Tobacco consumption and advertising restrictions: A critique of Laugesen and Meads (1991)'"'. International Journal of Advertising, 12: 81-84.
31. Stewart, MJ, 1993b. "The effect on tobacco consumption of advertising bans in OECD countries". International Journal of Advertising, 12: 155-180.
32. Sumner, MT, 1971. "The demand for tobacco in the UK", The Manchester School of Economic and Social Studies, 39: 23-36.
33. Townsend, J, 1987. "Cigarette tax, economic welfare and social class patterns of smoking", Applied Economics, 19: 355-65.
34. Townsend, J, 1996. "Price and consumption of tobacco". British Medical Bulletin, 52(1): 132-142.
35. Townsend, J, Roderick, P and Cooper, J, 1994. "Cigarette smoking by socioeconomic group, sex, and age: effects of price, income and health publicity". British Medical Journal, 309: 923-7.
36. US Department of Health and Human Services, 2000. Reducing tobacco use: A report of the Surgeon-General - Executive Summary. Atlanta, Georgia. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, and Office on Smoking and Health.
37. Van der Merwe, R, 1998a. "Chapter 9: An international comparison of tobacco control policies", in ETCSA, The Economics of Tobacco Control in South Africa, report submitted to the International Tobacco Initiative, School of Economics, University of Cape Town.
38. Van der Merwe, R, 1998b. "Chapter 16: Employment issues in tobacco control", in ETCSA, The Economics of Tobacco Control in South Africa, report submitted to the International Tobacco Initiative, School of Economics, University of Cape Town.
39. Van Walbeek, CP, 2004. The economics of tobacco control in South Africa. Unpublished draft Ph.D. thesis. Cape Town: University of Cape Town.

40. Warner, KE, 1989. "Effects of the antismoking campaign: An update". *American Journal of Public Health*, 79(2): 144-151.
41. Warner, KE. 1977. "The effects of the anti-smoking campaign on cigarette consumption", *American Journal of Public Health*, 67(7): 645-50.
42. Wasserman, J, Manning, WE, Newhouse, JP and Winkler, JD, 1991. "The effects of excise taxes and regulation on cigarette smoking". *Journal of Health Economics*, 1: 43-64.
43. Witt, SF and Pass, CL, 1981. "The effects of health warnings and advertising on the demand for cigarettes". *Scottish Journal of Political Economy*, 28(1):86-91.
44. World Bank, 1999. *Curbing the Epidemic: Governments and the Economics of Tobacco Control*. Washington, D.C.: The World Bank.

APPENDIX:

Regression results for different specifications of the demand for cigarettes in Jamaica

The following variables are used:

CIGCONSUMPTION	Aggregate cigarette consumption, expressed in thousands of units;
PC_CIGCONSUMPTION:	Per capita cigarette consumption, where the population is defined as all people aged above 15 years, expressed in units per person above age 15;
GDP95:	Gross domestic product, expressed in millions of constant 1995 Jamaica dollars;
PC_GDP95:	Per capita GDP, where the population is defined as all people aged above 15 years, expressed in constant 1995 Jamaica dollars; and
CIGPRICE95:	Price of a pack of 20 cigarettes, deflated by the Consumer Price Index (1995 = 100).

Equation 1

Dependent Variable: LOG(CIGCONSUMPTION)

Method: Least Squares

Sample(adjusted): 1974 2001

Included observations: 28 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.85317	1.602324	9.893859	0.0000
LOG(CIGPRICE95)	-0.478544	0.103070	-4.642898	0.0001
LOG(GDP95)	0.003696	0.144469	0.025582	0.9798
R-squared	0.518456	Mean dependent var		14.04056
Adjusted R-squared	0.479933	S.D. dependent var		0.107930
S.E. of regression	0.077835	Akaike info criterion		-2.167504
Sum squared resid	0.151456	Schwarz criterion		-2.024768
Log likelihood	33.34506	F-statistic		13.45818
Durbin-Watson stat	1.071700	Prob(F-statistic)		0.000108

Equation 2

Dependent Variable: CIGCONSUMPTION

Method: Least Squares

Sample(adjusted): 1974 2001

Included observations: 28 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1839749.	169635.6	10.84531	0.0000
CIGPRICE95	-12115.38	2592.444	-4.673344	0.0001
GDP95	0.083569	1.058235	0.078970	0.9377
R-squared	0.522208	Mean dependent var		1259437.
Adjusted R-squared	0.483985	S.D. dependent var		136052.9
S.E. of regression	97732.47	Akaike info criterion		25.91881
Sum squared resid	2.39E+11	Schwarz criterion		26.06155
Log likelihood	-359.8634	F-statistic		13.66203
Durbin-Watson stat	1.023284	Prob(F-statistic)		0.000098

Equation 3

Dependent Variable: LOG(CIGCONSUMPTION)

Method: Least Squares

Sample(adjusted): 1975 2001

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.515399	3.218692	2.956294	0.0071
LOG(CIGCONSUMPTION(-1))	0.426510	0.182347	2.339003	0.0284
LOG(CIGPRICE95)	-0.219392	0.128063	-1.713155	0.1001
LOG(GDP95)	-0.051508	0.129918	-0.396466	0.6954
R-squared	0.588836	Mean dependent var		14.03222
Adjusted R-squared	0.535206	S.D. dependent var		0.100361
S.E. of regression	0.068422	Akaike info criterion		-2.390297
Sum squared resid	0.107675	Schwarz criterion		-2.198321
Log likelihood	36.26901	F-statistic		10.97957
Durbin-Watson stat	1.937476	Prob(F-statistic)		0.000113

Equation 4

Dependent Variable: CIGCONSUMPTION

Method: Least Squares

Sample(adjusted): 1975 2001

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1076541.	356298.7	3.021457	0.0061
CIGCONSUMPTION(-1)	0.405956	0.176305	2.302581	0.0307
CIGPRICE95	-5669.599	3111.361	-1.822225	0.0815
GDP95	-0.359237	0.921734	-0.389740	0.7003
R-squared	0.599507	Mean dependent var		1247977.
Adjusted R-squared	0.547269	S.D. dependent var		124109.7
S.E. of regression	83507.56	Akaike info criterion		25.63922
Sum squared resid	1.60E+11	Schwarz criterion		25.83119
Log likelihood	-342.1294	F-statistic		11.47641
Durbin-Watson stat	1.931565	Prob(F-statistic)		0.000084

Equation 5

Dependent Variable: LOG(PC_CIGCONSUMPTION)

Method: Least Squares

Sample(adjusted): 1974 2001

Included observations: 28 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.594506	3.791113	1.211915	0.2369
LOG(CIGPRICE95)	-0.981293	0.182545	-5.375607	0.0000
LOG(PC_GDP95)	0.510734	0.285528	1.788739	0.0858
R-squared	0.724176	Mean dependent var		6.749786
Adjusted R-squared	0.702110	S.D. dependent var		0.229830
S.E. of regression	0.125440	Akaike info criterion		-1.213028
Sum squared resid	0.393377	Schwarz criterion		-1.070292
Log likelihood	19.98240	F-statistic		32.81870
Durbin-Watson stat	0.676197	Prob(F-statistic)		0.000000

Equation 6

Dependent Variable: PC_CIGCONSUMPTION

Method: Least Squares

Sample(adjusted): 1974 2001

Included observations: 28 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	792.2332	345.5018	2.292993	0.0305
CIGPRICE95	-14.25978	3.181539	-4.482040	0.0001
PC_GDP95	0.006624	0.001972	3.358394	0.0025
R-squared	0.732301	Mean dependent var		876.4263
Adjusted R-squared	0.710886	S.D. dependent var		210.3420
S.E. of regression	113.0995	Akaike info criterion		12.39537
Sum squared resid	319787.6	Schwarz criterion		12.53811
Log likelihood	-170.5352	F-statistic		34.19432
Durbin-Watson stat	0.573137	Prob(F-statistic)		0.000000

Equation 7

Dependent Variable: LOG(PC_CIGCONSUMPTION)

Method: Least Squares

Sample(adjusted): 1975 2001

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.065212	2.830941	1.082754	0.2901
LOG(PC_CIGCONSUMPTION(-1))	0.758793	0.122345	6.202092	0.0000
LOG(CIGPRICE95)	-0.233615	0.169326	-1.379671	0.1810
LOG(PC_GDP95)	-0.047718	0.216849	-0.220050	0.8278
R-squared	0.883281	Mean dependent var		6.731482
Adjusted R-squared	0.868057	S.D. dependent var		0.212396
S.E. of regression	0.077151	Akaike info criterion		-2.150158
Sum squared resid	0.136901	Schwarz criterion		-1.958182
Log likelihood	33.02713	F-statistic		58.01806
Durbin-Watson stat	2.274532	Prob(F-statistic)		0.000000

Equation 8

Dependent Variable: PC_CIGCONSUMPTION

Method: Least Squares

Sample(adjusted): 1975 2001

Included observations: 27 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	366.6249	252.9986	1.449118	0.1608
PC_CIGCONSUMPTION(-1)	0.758813	0.111510	6.804860	0.0000
CIGPRICE95	-3.161031	2.552372	-1.238468	0.2280
PC_GDP95	-0.000221	0.001625	-0.136331	0.8927
R-squared	0.890518	Mean dependent var	857.0475	
Adjusted R-squared	0.876237	S.D. dependent var	187.1521	
S.E. of regression	65.83995	Akaike info criterion	11.34828	
Sum squared resid	99702.68	Schwarz criterion	11.54026	
Log likelihood	-149.2018	F-statistic	62.35983	
Durbin-Watson stat	2.308269	Prob(F-statistic)	0.000000	